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INDIVIDUALIZING JUNIOR HIGH SCHOOL MATHEMATICS INSTRUCTION.
FINAL REPORT.
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THIS DOCUMENT REPORTS THE RESULTS OF AN INVESTIGATION INVOLVING SEVENTH GRADE MATHEMATICS TEACHERS OF THE VOLUSIA COUNTY, FLORIDA SCHOOLS WHO PARTICIPATED IN A TWO YEAR PROJECT TO EVALUATE INDIVIDUALIZED INSTRUCTION AS COMPARED TO CONVENTIONAL CLASSROOM INSTRUCTION. THE MATERIALS AND METHODS FOR THIS STUDY CONSISTED OF SPECIALLY PREPARED UNITS, EXERCISES, AND TESTS COVERING TRADITIONAL CONTENT OF SEVENTH GRADE MATHEMATICS. THE EFFECT OF THE MATERIALS WITH STUDENTS WAS COMPARED WITH CONVENTIONAL CLASSROOM INSTRUCTION USED WITH OTHER PUPILS BY THE SAME TEACHERS. DATA FOR ANALYSIS WERE OBTAINED FROM PRETESTS AND POST-TEST SCORES FROM THE CALIFORNIA ACHIEVEMENT TESTS. ANALYSES INDICATED THAT SOME CONTROL CLASSES ACHIEVED SIGNIFICANTLY HIGHER GAINS THAN DID THE EXPERIMENTAL CLASSES, BOTH IN REASONING AND IN FUNDAMENTALS. THE POOR SHOWING OF THE EXPERIMENTAL APPROACH WAS ATTRIBUTED, IN SOME ASPECTS, TO THE HEAVY DEMANDS PLACED UPON THE TEACHERS BY THE MANIPULATION OF THE EXPERIMENTAL MATERIALS. THE MATERIALS WERE FELT TO NEED EDITORIAL IMPROVEMENT AND REVISION IN ORDER TO PROVIDE MORE ADEQUATELY FOR THE NEEDS OF SLOWER PUPILS. (RP)

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FINAL REPORT
Project No. 1365
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INDIVIDUALIZING JUNIOR HIGH SCHOOL MATHEMATICS INSTRUCTION

August 1967

U.S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE

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Bureau of Research

INDIVIDUALIZING JUNIOR HIGH SCHOOL MATHEMATICS INSTRUCTION: AN EXPERIMENTAL STUDY

Project No. 1365
Contract No. OE 2-10-038

Joseph T. Sutton

August 25, 1967

The research reported herein was performed pursuant to a contract with the Office of Education, U.S. Department of Health, Education, and Welfare. Contractors undertaking such projects under Government sponsorship are encouraged to express freely their professional judgment in the conduct of the project. Points of view or opinions stated do not, therefore, necessarily represent official office of Education position or policy.

Stetson University

DeLand, Florida

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CHAPTER I

INTRODUCTION

Individual differences among pupils have long been recognized as a most complicating factor in the provision of classroom instruction. Nowhere in education is this more true than in the field of mathematics and at the level of the junior high school. The purpose of this study was to develop and evaluate teaching materials and methods for the individualization of junior high school mathematics instruction.

At the time this project was initiated there was a great interest in new approaches to junior high school mathematics. Numerous curricula revisions and reform movements were underway, characterized by The School Mathematics Study Group, the University of Maryland Mathematics Project, the University of Illinois Committee on School Mathematics and others, (NCTM, 1961). There was also, in some quarters, much enthusiasm concerning the development of auto-instructional materials and devices, (Crain, 1962). Nevertheless, Florenoy (1960) could write:

> At this time we have no published research in the field of arithmetic which aids a school faculty or a teacher in the decision as to what variations to make, when, how, and how much. Many teachers have a fine attitude toward the problem of meeting individual differences, however the task of selecting varied activities and getting these ideas before the children at the right time continues to be difficult for teachers to handle.

The problem of adapting instruction to individual differences is as old as the history of education and the literature is voluminous. Several early research antecedents of this project were reported in the twenty-fourth yearbook, Part II of the National Society for the Study of Education, (NSSE, 1925). Notable among these were the contributions of Frederich Burk of San Francisco State College who developed self-instruction tests and provided for strictly individual progress in the "common essentials." The work of Carlton W. Washburne at Winnetka, Illinois, and Stuart A. Courtis in Detroit is also well-known and historically significant.

Whitaker (1960) described a procedure for adapting the materials and methods of instruction to individual differences that appeared to be promising. No data were presented in support of his presentation and the editor of the journal commented upon the need for research

evidence. At about the same time a very similar approach was reported by Sganga (1960). Whitaker and Sganga were both in the tradition of Burk and Washburne in their selections of materials and methods.

A careful investigation of pupil progess using materials and methods applied by teachers largely unskilled in the new mathematical concepts and unequipped with autoinstruction devices seemed indicated. If the advantages for such a program can be demonstrated when these materials and methods were packaged and disseminated through the medium of an inservice education program, such a project would have many practical implications.

Objectives

The project was both hypothesis testing and hypothesis seeking. The design of the study permitted the testing of the null hypothesis regarding the achievement gains of pupils taught by the individualized methods as opposed to pupils taught in conventional ways. In the process of conducting the experiment it was also possible to make a variety of observations that raise new questions regarding the problem of individualization of instruction. Attention was given to seeking more specific hypotheses relating methods and materials of instruction to the improvement of junior high school mathematics instruction.

CHAPTER II

METHOD

Assignment of Pupils and Classes to Treatments

At the beginning of the 1961 school year all teachers assigned to seventh grade mathematics classes in Volusia County, Florida, schools were contacted by the project staff and invited to participate in the study. Of twenty-nine teachers so assigned all but one volunteered to participate. The one teacher who declined was committed to an experimental study already underway.

Assignment of pupils to classes and of classes to treatments was accomplished in the following manner. Eight teachers who had been assigned by their schools to teach but one section of seventh grade mathematics were asked to administer the experimental treatment to their classes. In these eight cases it was not possible to control the assignment of pupils to the classes. These sections were generally the only mathematics sections in small schools or overflow sections created to relieve a scheduling difficulty in larger schools. Twenty teachers were assigned more than one section of seventh grade mathematics. The experimental and control treatments were assigned to the classes in a random fashion with the restriction that each teacher have at least one control and one experimental section. Certain exceptions to the above must be mentioned. In one school students were sectioned in classes according to test scores. This situation made it possible to assign one teacher two classes of "bright" students and two classes of "dull" students. Control and experimental treatments were randomly assigned to these classes so that the data could be analyzed in a two-by-two factorial design. In another situation the school did not wish to employ any control sections. Data for three classes in this school were therefore treated with the eight singleton classes. Generally, in the schools in which these teachers taught, pupils were assigned to classes in a random manner.

In many small ways, as every educational researcher is aware, the effort to assign students in a strictly random fashion suffered from the exigencies of school administration. The assignment of treatments to classes, however, was strictly random. Teachers had been assigned to schools and to seventh grade mathematics instruction by the County Board of Education prior to the beginning of the study.

Table 1 presents the number of teachers, schools and pupils who participated in the project in the Fall of 1961. Sixty-six classes

TABLE 1

Participating Teachers and Schools with the Number of Classes and Pupils Assigned to Experimental and Control Treatments School Year 1961-62

Schools	Teachers	Experimental No. Classes	Experimental No. Pupils	Control No. Classes	Control No. Pupils
I	A	2	61	4	112
	B	1	33	1	33
	C	1	8		
II	D	1	26	1	31
	E	1	32	1	29
	F	1	30		
III	G	4	115	2	80
	H	1	26	1	28
IV	I	2	56	3	76
	J	2	49	2	50
V	K	2	48	1	23
	L	1	24	1	27
VI	M	2	60	1	23
	N	1	28		
VII	O	2	44	2	47
VIII	P	1	20	1	22
IX	Q	1	24	1	24
X	R	1	34	1	36
XI	S	1	17	1	30
XII	T	1	28	1	25
XIII	U	1	18	1	15
XIV	V	1	22	1	24
XV	W	3	71		
XVI	X	1	13		
XVII	Y	1	24		
XVIII	Z	1	23		
XIX	AA	1	19		
XX	BB	1	38		
TOTALS 20	28	38	991	27	735

in twenty schools taught by twenty-eight teachers enrolled 1,723 pupils in both experimental and control sections. All of the schools and teachers had at least one experimental section. Appendix A lists the names of the participating teachers.

The Experimental Treatment

The experimental treatment consisted of the teaching materials and method prepared for this project. The materials consisted of mimeographed units containing the traditional content of seventh grade mathematics. The "traditional" label is applied to these materials inasmuch as they did not include those topics characteristically found in "modern" mathematics, e.g. numeration, laws of the number system, or elementary number theory (Schult, 1959). The unit topics are given in Table 2.

Each unit consisted of a major topic subdivided into two or more parts. Each part began with a brief overview of the major concepts along with an illustrative excercise known as an "experiment." This was followed by a "self diagnostic" test. Several pages of more detailed exposition and numerous excercises completed the part. After the last part in each unit there was a "self test." Keys to the "self test" were available to the student at any time.

The teacher had a supply of three prepared tests for each unit labeled "A," "B," and "C," which were essentially parallel to the Self Test in both content and form. Only the teachers had access to the keys to Tests A, B, and C. The following description of the organization of the unit materials and method was used to orient the teachers to the project:

> It is intended that all students start at the beginning of the text materials, even though the material may seem quite elementary. The idea is to expose all students to the concepts dealt with briefly at the beginning of each unit and to have everyone do the experiments contained within the units.
>
> However, it is not necessary for all students to do each unit in its entirety. Immediately following the initial explanatory portion of the unit is a SELF DIAGNOSTIC TEST made up of 20 items. Passing this test enables the student to skip over to the next part of the unit. For example:
>
> 1. A student reads the short introduction to whole numbers until he reaches the diagnostic test on READING AND WRITING WHOLE NUMBERS.
>
> 2. Passing the diagnostic test permits him to skip to part II of the unit on ADDITION. The same pattern

TABLE 2

Topic Headings of the Experimental Materials

Unit Number	Topic
1	Number system - addition and subtraction
2	Multiplication and division
3	Introduction to fractions
4	Addition and subtraction in fractions
5	Multiplication and division of fractions
6	Introduction to decimals - addition and subtraction
7	Multiplication and division of decimals
8	The meaning of per cent
9	Using per cent
10	Ratio and proportion
11	Lines, squares, and areas
12	Geometric figures
13	Volume and the third dimension
14	Measurements
15	How to make and use graphs
16	An introduction to signed numbers
17	Some interesting topics in arithmetic
18	Right angles, right triangles and the Pythagorian Theorem

continues through the unit:

a) Read concepts. b) Take diagnostic test. c) Skip to next part if test is passed.

3. Failing the diagnostic test will necessitate continuing page by page in the unit without skipping any of the text material until the next diagnostic test is taken.

There are 4 prepared tests with accompanying keys on each unit. One is a SELF TEST for which no grade is given. Having passed this test, the student then asks for TEST A. Passing this test will permit the student to proceed to the next unit. Failing the test will necessitate a review of the unit and the taking of TEST B. An additional failure will mean another review and the taking of TEST C. It is suggested that the total possible score on TEST B be limited to 90, and that a failing grade be given for TEST C regardless of the score made. The passing of TEST C merely enables the student to begin the next unit.

The main purpose of the testing program is to try to have each student learn a particular unit thoroughly before permitting him to advance to new material. Also, an attempt has been made, through the use of self tests, to help insure that a student experiences success upon taking the first test. All tests will contain 20 items; 15 are manipulative and 5 are in word form.

At the beginning of each class period the student would pick up his materials from the teacher or a storage file and proceed with his work from the place he had reached the previous class period. Whenever a student felt he needed help he could solicit aid from the teacher by either raising his hand or going to the teacher. Appendix B contains suggestions to the teachers for the use of the special materials. Appendix C contains instructions to the students in the experimental classes.

Within the broad framework of the procedure dictated by the nature of the materials each teacher was permitted considerable latitude in the administration of his classroom. Each teacher was also free to teach his control sections, if any, in the manner in which he wished. The experimental materials were not to be used in control classes, however. The only common denominators of the control classes was the use of a state adopted textbook and the fact that a significant portion of the teachers' time was spent in group instruction.

Inservice Education

Prior to the beginning of the classes in the fall, a two-day

workshop was held for the teachers. At that time the teachers were acquainted with the materials of instruction and also with the methods by which they should be used. Throughout the school year all teachers associated with the program met with the project staff twice each three-week cycle to review progress and to discuss problems.

Slightly more than half of the teachers resided on the eastern side of the county, and they formed the East Volusia area group. The remainder of the teachers formed the West Volusia area group. On the first Monday of each cycle the East-side group would meet with the staff, and the West-side would meet on the second Monday. On the third Monday all teachers would convene in a general meeting. The area meetings were largely devoted to the participating teachers to permit them to share problems they had encountered with the materials, methods, or children. At the somewhat more formal general meeting, the staff would present selected mathematical or psychological topics. Also at the general meeting, materials would be distributed, corrected, collected, etc.

Extension of the Project

As the year progressed it became apparent that local interest in the project was sufficiently strong to warrent a request for additional funds from the Volusia County School Board and to request an extension of time on the original plan from the U.S. Office of Education. Both requests were granted and additional data was collected over the year 1962-63.

No particular design was followed in assigning sections to teachers in the year 1962-63. Assignment of pupils to classes was done largely on a pupil preference basis. A correlational study of teacher characteristics vs. student gains is reported from data collected during the 1962-63 school year, (Romano, 1963).

The Dependent Variable

The California Achievement Battery (Junior High School, Form W) was administered to all seventh grade pupils in the county during the first week of the 1960-61, 1961-62, and 1962-63 school years. A parallel form of the same test, (Form Y) was given to all seventh grade pupils during the last week of the school years 1960-61, 1961-62, and 1962-63. The tests were administered and scored under the direction of the Volusia County Director of Testing. The data obtained from these testing periods constitute the dependent variable of the experiment. Separate analyses of the reasoning and fundamentals sub-scores of the mathematics tests were made. All statistical analyses were computed from gain scores derived from the before-and-after testing. Raw scores were converted to grade level scores using the 1957 norms.

The Experimental Designs

No single design would permit the interpretation of all the test score information that collected in this project. Various analyses were selected to extract information from various subsets of the data. The methods of assigning pupils to classes, classes to teachers, and teachers to treatments determined which subsets of data were included in any single analysis.

The Groups-Within-Treatments Design

Of the nine teachers who taught no control classes during the school year 1961-62 (see Table 1), five taught conventional seventh grade mathematics in the same school the previous year. Seven of the remaining nineteen teachers in the project who had control classes the year of the project were also found to have taught conventional classes the previous year from which appropriate gain scores could be obtained. Consequently, data from the pupils of these twelve teachers formed a subset of the project that was analyzed by a groups-within-treatments design (Lindquist, 1953). The assumption was made that the students in the experimental classes were representative of the same population as were the students in the conventional classes the previous year. An additional assumption regarding no systematic differences in other variables that influenced student achievements between the two years was also necessary. In the absence of any contradictory evidence available to the project staff this assumption appears tenable. There was a design advantage in using the previous-year classes as controls inasmuch as these control students could not have been influenced in any manner by teachers or fellow students who were simultaneously engaged with the experimental treatment.

The scores for all the students taught by a given teacher were averaged and this group mean was the unit of sampling in the analyses. The unweighted mean was used, although there were considerable differences in numbers of students among the twelve teachers. The teaching style and personality of the teacher is inextricably associated with the methods and materials and it did not appear to be desirable to give more weight to characteristics associated with a given teacher simply because the number of pupils taught by that teacher happened to be greater than those taught by some other.

The Random Replications Design

In 1961-62 nineteen teachers taught two or more sections that had been randomly apportioned among experimental and control treatments, (see Table 1). The mean unweighted gain scores from all students in a given treatment taught by a single teacher was again the basis of sampling for this analysis.

The difference in scores from the fall of 1961 to the spring of 1962 revealed gains over the school year. Retesting of all students who still remained in the system in the fall of 1962 provided a look at the persistence over the summer of any differences that might have appeared between the treatment groups during the school year. All 1961-62 pupils were not available for testing in the fall of 1962. It was assumed that there were no systematic differences in attrition or mobility of students as a function of the mathematics treatment received in the seventh grade.

The Treatment-by-Levels Design

In one school, it will be recalled, students were sectioned into high and low-ability classes. Sectioning by ability level was accomplished by the school psychologist who considered intelligence and achievement test scores as well as academic records. Assignment to a particular section of bright or dull students was random. The sections were randomly assigned to experimental or control treatments. Four classes taught by one teacher constituted a 2-by-2 treatment-by-levels design. Attrition had been unequal in the sections at the end of the year. The records of students in the larger sections were selectively discarded until all sections were the same size (N = 20). Selection was on the basis of the best match with fall achievement test scores in the comparable ability group.

CHAPTER III

RESULTS

The empirical hypothesis that the experimental treatment, i.e. individualized mathematics instruction, would be superior to the control treatment, i.e. conventional classroom group instruction, was tested in three different analyses. The three analyses used data from overlapping subsamples of the project population. Each analysis used information from as much of the total population as was admissible under the assumptions governing interpretation of the results with that design.

Groups-Within-Treatments Results

Twelve teachers taught control classes in 1960-61 and experimental classes in 1961-62. The data from these classes composed the groups-within-treatments design. The mean arithmetic test scores and gains for these groups are presented in Tables 3 and 4. The control "N" was considerably larger than the experimental "N" e.g., 675 pupils in twenty-eight classes as opposed to 416 pupils in nineteen classes. This difference exists because seven of the twelve teachers taught control classes in addition to experimental classes in 1961-62, whereas they taught only control classes in 1960-61.

The unweighted mean gain in arithmetic reasoning for the control group was 1.12 grade level units (Table 3). The comparable value for the experimental group was .79 units. This difference in treatments is not found to be significant. The analysis of variance of these data is summarized in Table 5 ($F = 4.13$; $df = 1/22$, $p > .05$). The mean gain in arithmetic fundamentals was 1.52 in the control treatment and 1.49 in the experimental treatment. This difference did not approach significance, see Table 6 ($F = 1.12$; $df = 1/22$, $p > .05$).

Random-Replications Results

Of the nineteen teachers who taught both control and experimental classes during the school year 1961-62 (Table 1), eighteen provided before-and-after arithmetic test score data from the California achievement test. The data from one teacher was lost due to an irregularity in the administration of the achievement tests in the spring of 1962. "After" testing was done in the spring of 1962 and again in the fall at the beginning of the 1962-63 school year. Two gain scores were obtained on all pupils remaining in Volusia County schools by subtracting their "before" scores (fall 1961-62) from

TABLE 3

Mean Arithmetic Fundamentals Scores for Students of
All Teachers with Previous Year Classes as Controls

Teacher	Control 1960-61					Experimental 1961-62				
	No. Students	No. Classes	Fall	Spring	Gain	No. Students	No. Classes	Fall	Spring	Gain
P	41	2	8.52	9.73	1.20	19	1	7.49	9.36	1.87
O	113	4	7.17	9.32	2.15	43	2	7.12	8.78	1.66
N	31	1	7.99	9.89	1.90	25	1	6.50	7.64	1.13
D	54	2	7.48	8.90	1.42	21	1	5.85	6.93	1.08
K	78	3	5.99	6.83	.84	37	2	6.06	6.68	.61
Q	39	2	8.28	10.55	2.27	21	1	7.50	9.39	1.89
Y	21	1	6.40	6.54	.14	21	1	6.33	7.40	1.07
Z	33	2	7.67	9.33	1.67	22	1	7.54	9.16	1.62
S	33	2	6.88	8.76	1.88	15	1	6.80	8.39	1.59
G	156	6	6.90	8.75	1.85	106	4	6.88	8.41	1.53
V	53	2	7.38	8.68	1.31	20	1	6.88	8.70	1.82
W	23	1	7.51	9.06	1.55	66	3	7.31	9.28	1.97
Total	675	28	88.17	106.34	18.18	416	19	82.26	100.12	17.84
Unweighted Mean	56.25	2.33	7.35	8.86	1.52	34.67	1.58	6.86	8.34	1.49

TABLE 4

Mean Arithmetic Reasoning Scores for Students of All Teachers with Previous Year Classes as Controls

Teacher	Control 1960-61					Experimental 1961-62				
	No. Students	No. Classes	Fall	Spring	Gain	No. Students	No. Classes	Fall	Spring	Gain
P	41	2	8.14	9.35	1.20	19	1	7.73	8.65	.93
O	113	4	7.65	9.20	1.55	43	2	7.31	8.23	.91
N	31	1	7.87	8.93	1.06	25	1	6.88	7.64	.76
D	54	2	7.60	8.88	1.28	21	1	6.48	7.05	.57
K	78	3	6.21	6.71	.50	37	2	6.28	6.55	.27
Q	39	2	8.23	9.93	1.70	21	1	8.00	8.65	.65
Y	21	1	6.77	7.27	.50	21	1	7.15	8.45	1.30
Z	33	2	7.90	9.29	1.39	22	1	7.80	8.60	.80
S	33	2	6.79	8.62	1.83	15	1	6.83	7.91	1.07
G	156	5	7.16	8.02	.86	106	4	7.23	7.80	.57
V	53	2	7.92	8.25	.34	20	1	7.73	8.58	.85
W	23	1	7.98	9.21	1.23	66	3	7.71	8.54	.83
Total	675	28	90.22	103.66	13.44	416	19	87.13	96.65	9.51
Unweighted Mean	56.25	2.33	7.52	8.64	1.12	34.67	1.58	7.26	8.05	.79

TABLE 5

Analysis of Variance of Arithmetic Reasoning Gain Scores (From Fall to Spring) with Previous Year Classes as Controls

Source of Variation	Sum of Squares	df	Mean Square	F
Total	4.00	23		
Treatments	.63	1	.63	4.13
Groups Within	3.37	22	.15	

TABLE 6

Analysis of Variance of Arithmetic Fundamentals Gain Scores (From Fall to Spring) with Previous Year Classes as Controls

Source of Variation	Sum of Squares	df	Mean Square	F
Total	6.12	23		
Treatments	.29	1	.29	1.12
Groups Within	5.83	22	.22	

their "after" scores (spring 1962 and fall 1962). The numbers of classes and students with the mean test scores and gains involved in this analysis are given in Tables 7 and 8.

The mean gains in reasoning for the school year were 1.14 for the control classes and .84 for the experimental classes. These data were subjected to Lindquist's random replications analysis of variance. The result of this analysis is summarized in Table 8, ($F = 5.13$; $df = 1/17$; $p < .05$). The null hypothesis regarding treatments is rejected.

Using reasoning gain scores computed from the tests administered one calendar year after the initial tests, the unweighted means were .99 for the control group and .77 for the experimental group. The analysis of variance of these data does not permit rejection of the null hypothesis, see Table 9, ($F = 3.75$; $df = 1/17$; $p > .05$).

The mean scores and gains in arithmetic fundamentals for the random-replications design are presented in Table 8. The fall-to-

TABLE 7

Mean Arithmetic Reasoning Scores and Gains for
Academic Year (Spring) and Calendar Year (Fall) 1961-62

	Control 1961-62						Experimental 1961-62					
Teacher	No. Classes	No. Students	Fall	Spring Gain	No. Students	Fall Gain	No. Classes	No. Students	Fall	Spring Gain	No. Students	Fall Gains
M	1	27	7.64	2.27	25	.74	2	58	7.57	1.39	53	.12
P	1	20	8.16	1.29	20	1.25	1	19	7.73	.93	19	1.30
H	1	24	7.66	.70	21	-.16	1	24	7.58	.73	23	-.19
B	1	32	7.69	1.26	28	1.40	1	32	7.54	.56	26	1.18
A	4	101	7.55	1.31	85	1.53	2	54	7.65	.93	43	1.17
D	1	31	7.30	.72	25	1.24	1	22	6.52	.55	12	1.14
K	1	19	5.72	.83	16	.71	2	44	6.22	.22	33	.36
E	1	29	6.72	.64	6	.58	1	29	7.27	1.21	25	1.50
Q	1	22	8.26	2.00	19	1.80	1	21	8.00	.65	19	.50
R	1	29	8.05	1.01	25	1.20	1	33	8.52	1.15	31	1.42
J	2	48	6.46	.31	46	.34	2	44	6.06	.64	41	.74
L	1	25	5.57	1.42	22	1.38	1	23	6.03	.54	19	.29
S	1	18	6.59	.92	10	1.99	1	15	6.83	1.07	11	1.56
G	2	57	7.03	1.24	48	1.29	4	107	7.20	.58	90	.79
T	1	21	7.68	1.65	18	1.66	1	28	8.15	1.33	25	1.59
I	3	70	6.54	.28	67	.79	2	49	6.71	.96	47	.56
V	1	22	7.37	1.36	18	.16	1	20	7.73	.85	18	-.19
O	2	37	7.46	1.32	32	-.06	2	42	7.36	.90	40	-.06
TOTAL	26	632	129.45	20.53	531	17.84	27	664	130.67	15.19	575	13.78
UNWEIGHTED MEAN	1.44	35.11	7.19	1.14	29.50	.99	1.50	36.89	7.26	.84	31.94	.77

TABLE 8

Mean Arithmetic Fundamentals Scores and Gains for Academic Year (Spring) and Calendar Year (Fall) 1961-62

	Control 1961-62						Experimental 1961-62					
Teacher	No. Classes	No. Students	Fall	Spring Gain	No. Students	Fall Gain	No. Classes	No. Students	Fall	Spring Gain	No. Students	Fall Gains
M	1	27	7.82	2.14	25	2.90	2	58	7.52	1.46	53	1.81
P	1	20	8.84	1.20	20	.58	1	19	7.50	1.87	19	1.61
H	1	24	7.64	1.08	21	1.64	1	24	7.55	1.41	23	1.23
B	1	32	8.19	1.13	28	.87	1	32	7.11	1.48	26	1.22
A	4	101	8.14	1.08	85	1.17	2	54	7.50	1.54	43	1.80
D	1	31	6.88	2.08	25	1.08	1	22	5.91	1.00	12	1.20
K	1	19	5.89	.72	15	1.01	2	37	5.95	.61	33	.37
E	1	28	6.10	1.35	6	.93	1	29	6.74	1.98	25	1.25
Q	1	22	8.52	1.91	19	1.61	1	21	7.50	1.90	19	1.76
R	1	29	7.90	1.73	25	1.52	1	33	8.50	2.02	31	1.14
J	2	48	5.74	.61	46	.41	2	44	5.74	.66	41	.59
L	1	25	5.65	.69	22	.66	1	23	5.85	.29	19	.12
S	1	18	6.38	1.20	10	1.40	1	15	6.80	1.59	11	1.66
G	2	57	6.99	2.42	48	1.86	4	107	6.84	1.54	81	1.40
T	1	21	7.81	2.01	18	1.18	1	28	8.49	1.90	25	1.56
I	3	70	6.28	.70	67	.98	2	49	6.54	.42	47	.74
V	1	22	7.02	1.44	18	1.51	1	20	6.88	1.82	18	2.08
O	2	37	6.84	2.07	32	2.05	2	42	7.12	1.72	40	2.33
TOTAL	26	631	128.63	25.56	530	23.36	27	657	126.04	25.21	566	23.87
UNWEIGHTED MEAN	1.44	35.05	7.15	1.42	29.44	1.30	1.50	36.50	7.00	1.40	31.44	1.33

TABLE 9

Analysis of Variance of Arithmetic Reasoning Gain Scores (From Fall to Spring) with Same Year Classes as Controls

Source of Variation	Sum of Squares	df	Mean Square	F
Total	7.17	35		
Treatments	.77	1	.77	5.13*
Replications	3.92	17	.23	
Treatments-by-Replications	2.48	17	.15	

*Significant at p .05 for 1 and 17 df.

TABLE 10

Analysis of Variance of Arithmetic Reasoning Gain Scores (From Fall to Fall) with Same Year Classes as Controls

Source of Variation	Sum of Squares	df	Mean Square	F
Total	13.68	35		
Treatments	.47	1	.47	3.75
Replications	11.07	17		
Treatments-by-Replications	2.14	17	.13	

spring gain was found to be 1.42 for the control group and 1.40 for the experimental group. This small difference between these means is, of course, not significant, see Table 11 ($F < 1.0$).

The results of the analysis of gains in fundamentals from fall 1961 to fall 1962 were essentially the same as the previous analysis. For the full calendar year the mean gains of 1.30 for the control group and 1.33 for the experimental group were not significantly different from chance expectations, see Table 12 ($F < 1.0$).

TABLE 11

Analysis of Variance of Arithmetic Fundamentals Gain Scores (From Fall to Spring) with Same Year Classes as Controls

Source of Variation	Sum of Squares	df	Mean Squares	F
Total	11.02	35		
Treatments	.004	1	.004	< 1.00
Replications	8.78	17	.52	
Treatments-by-Replications	2.23	17		

TABLE 12

Analysis of Variance of Arithmetic Fundamentals Gain Scores (From Fall to Fall) with Same Year Classes as Controls

Source of Variation	Sum of Squares	df	Mean Squares	F
Total	11.88	35		
Treatments	.01	1	.01	< 1.00
Replications	9.46	17		
Treatments-by-Replications	2.41	17	.14	

Treatments-by-Levels Results

A closer look at treatment effects is afforded by the treatments-by-levels analysis. This analysis used individual pupil scores as the unit of sampling. The four classes constituting the subset for this design met the criteria of random assignment of pupils to classes as well as random assignment of classes to treatments. All four classes were taught by the same teacher. Arithmetic reasoning mean scores and gains for the four classes, classified by both ability level and treatment condition, are given in Table 13.

As in the previous analyses, control gains in reasoning (1.24 and 1.41) were found to be greater than experimental gains (.71 and .44). The treatment-by-levels analysis of these data is shown in Table 14. The main effect of treatments was clearly significant ($F = 10.14$; $df = 1/76$; $p < .01$). However, the interaction of treatments with levels was not sifnificant ($F < 1.0$).

TABLE 13

Mean Arithmetic Reasoning Scores for High and Low Ability Classes in Control and Experimental Treatments. (N = 20 for each class)

	Control			Experimental			Total		
	Fall	Spring	Gain	Fall	Spring	Gain	Fall	Spring	Gain
High	7.89	9.12	1.24	8.01	8.72	.71	7.95	8.92	.98
Low	6.76	8.17	1.41	6.77	7.21	.44	6.77	7.69	.92
TOTAL	7.33	8.65	1.33	7.39	7.96	.58	7.36	8.31	.95

TABLE 14

Analysis of Variance of Arithmetic Reasoning Gain Scores (From Fall to Spring) from Two Ability Levels

Source of Variation	Sum of Squares	df	Mean Square	F
Total	97.70	79		
Treatments	11.25	1	11.25	10.04**
Levels	.05	1	.05	
(Cells)	(12.30)	(3)		
Treatments-by-Levels	1.00	1	1.00	< 1.00
Within Cells	85.40	76	1.12	

**Significant at P .01 for 1 and 76df.

The control mean gains (2.09 and 2.87) were larger than the experimental gains (1.72 and 1.12). These differences between treatments were found to be significant, see Table 16 ($F = 16.38$, $df = 1/76$; $p < .01$). Interaction of treatments with levels in regard to mean gains in arithmetic fundamentals was found, see Table 16 ($F = 6.80$; $df = 1/76$; $p < .05$). Gains in arithmetic fundamentals for these four classes are given in Table 15.

TABLE 15

Mean Arithmetic Fundamentals Scores for High and Low Ability Classes in Control and Experimental Treatments. (N = 20 for each class)

	Control			Experimental			Total		
	Fall	Spring	Gain	Fall	Spring	Gain	Fall	Spring	Gain
High	8.50	10.66	2.09	7.63	9.34	1.72	8.09	10.00	1.91
Low	6.12	8.99	2.87	6.24	7.37	1.12	6.18	8.18	2.00
TOTAL	7.34	9.82	2.48	6.93	8.35	1.42	7.13	9.08	1.95

TABLE 16

Analysis of Variance of Arithmetic Fundamentals Gain Scores (From Fall to Spring) From Two Ability Levels

Source of Variation	Sum of Squares	df	Mean Square	F
Total	137.90	79		
Treatments	22.78	1	22.78	16.38**
Levels	.17	1		
(Cells)	(32.40)	(3)		
Treatments-by-Levels	9.45	1	9.45	6.80*
Within Cells	105.50	76	1.39	

** Significant at $P < .01$ for 1 and 76 df.
* Significant at $P < .05$ for 1 and 76 df.

Achievement Gains and Progress in the Experimental Units

A major characteristic of the experimental treatment was the provision of materials, (i.e. the units consisting of text and tests, see Table 2) that permitted each pupil to progress independently of other students. A look at progress through the units as related to measured achievement gains provides useful information.

Evaluation of achievement gain scores of individuals is complicated by regression effects. Within group correlations of individual gains with initial scores are typically small and frequently negative. The relationship of achievement gains to progress in the

units was therefore computed from mean class gains. The selection of an appropriate measure to express progress through the units required some attention. Late in the school year many teachers were concerned with the large number of pupils who were "bogged down" in the early units, (see Figure 1). They consequently imposed changes in their procedures in order to move these pupils more rapidly. These changes consisted of such practices as reducing or eliminating the minimum score needed on a unit test in order to move to the next unit. The effect of this was to cause an "end spurt" in the number of units completed toward the end of the school year and, consequently, to result in a number of total units completed that was unrepresentative of the rate with which the pupils moved through most of the year. The mean number of units completed as of March 8, 1962 was selected as representative of the ad lib pace followed by the pupils in each class through most of the school year.

The positive skewness revealed in Fig. 1 was characteristic of individual class distributions. The mean and median number of units completed by each of the thrity-seven classes on which data were available are presented along with arithmetic achievement scores in Table 17. The product-moment correlations of the number of units completed with fall arithmetic test scores and with arithmetic gains are presented in Table 18.

The significant relationships between fall scores and units, between gains and units, and between fall scores and gains found in Table 18, raised the question of the relationship between the number of units completed and gains if the influence of fall scores were to be partialled out.

The correlation of reasoning gains with number of units completed was found to be .30 with the variance due to initial score differences removed. The correlation between units completed and fundamental gains disappeared entirely when fall fundamental scores are partialled out, (see Table 18).

Correlations between mean arithmetic gain scores and initial achievement means were computed for the eighteen control and eighteen experimental groups presented in Tables 7 and 8. These results, presented in Table 19, are of interest in comparing the two treatments. These coefficients were transformed to Fisher's *z* and tested for significant differences among them. They were not found to be reliably different at the .05 confidence level.

Questions Asked by Pupils in the Experimental Sections

It became apparent relatively early in the school year 1961-62 that the experimental method was very demanding upon the teacher's time. With class sizes ranging up to thirty-eight pupils, many

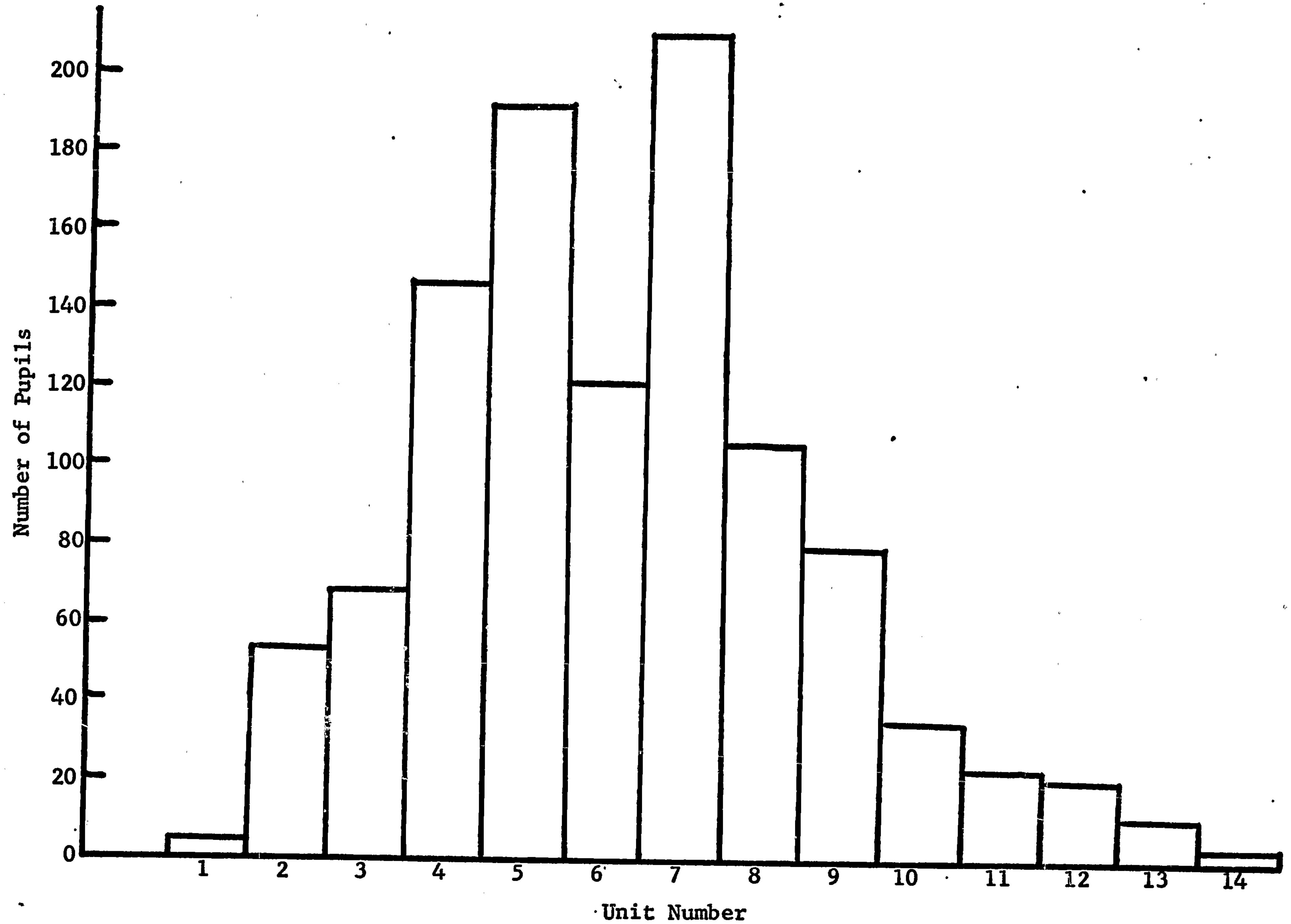

FIGURE I

Distribution of Pupils Over the Experimental Units
on March 8, 1961 (N = 1065)

TABLE 17

Average Number of Units Completed by Experimental Classes
On March 8, 1962 and Mean Arithmetic Achievement Scores

Class	Experimental Units Completed		Mean Arithmetic Scores			
			Reasoning		Fundamentals	
	Median	Mean	Fall	Gain	Fall	Gain
1	4.0	4.0	6.1	.24	5.7	.89
2	5.2	5.8	7.4	.63	7.0	2.32
3	4.9	5.9	7.5	.56	7.1	1.48
4	4.2	5.4	7.7	.74	7.6	1.27
5	4.8	5.5	7.6	1.10	7.4	1.77
6	3.8	4.5	6.3	.25	5.9	.46
7	3.8	4.5	6.1	.19	6.0	.77
8	3.6	4.1	7.5	1.55	8.1	.73
9	5.8	6.1	7.5	.55	7.1	.75
10	5.6	5.9	6.0	.54	5.9	.29
11	5.0	6.1	6.8	1.07	6.8	1.59
12	6.6	7.2	7.4	.71	6.9	.86
13	7.2	8.0	7.7	.93	7.5	1.87
14	5.2	5.5	7.6	.73	7.6	1.41
15	6.5	7.0	8.0	.65	7.5	.19
16	6.6	7.1	6.9	1.68	6.8	1.07
17	6.0	6.4	7.8	.76	7.5	1.62
18	8.6	9.5	8.2	1.33	8.5	1.90
19	6.8	6.9	8.6	1.01	8.5	2.25
20	4.5	5.1	7.6	.86	7.2	1.97
21	4.1	4.5	7.2	.62	6.5	1.62
22	7.9	8.3	7.5	1.50	7.5	1.58
23	6.7	7.6	7.6	1.28	7.5	1.33
24	6.4	6.5	7.4	.85	7.2	1.96
25	5.3	5.9	7.4	.96	7.0	1.40
26	4.3	5.5	6.9	.75	6.5	1.13
27	7.9	8.8	8.5	1.15	8.5	2.02
28	5.5	5.8	7.1	.37	6.7	1.67
29	5.5	6.0	7.1	.53	6.6	1.20
30	5.9	6.3	7.2	.85	6.9	1.70
31	5.5	6.3	7.4	.51	7.2	1.59
32	3.6	4.0	6.5	.55	5.9	1.00
33	6.6	7.5	7.3	1.21	6.7	1.98
34	2.8	3.5	5.7	.85	5.9	.37
35	3.3	3.8	6.4	.45	5.6	.93
36	6.3	7.7	7.6	.57	7.3	.58
37	5.0	5.9	7.7	.85	6.9	1.82

TABLE 18

Product-Moment Correlations Among Class Means of Units Completed, Fall Achievement Scores and Achievement Gains. (N = 37)

	Units completed	Gains
Reasoning:		
Fall Scores	.70*	.44*
Gains	.50*	
Gains (Fall Scores partialled out)	.30	
Fundamentals:		
Fall Scores	.67*	.50*
Gains	.33*	
Gains (Fall Scores partialled out)	.00	

TABLE 19

Correlations of Mean Fall Achievement Scores with Mean Gain Scores within Treatments. (N = 18)

Control		Experimental	
Reasoning	Fundamentals	Reasoning	Fundamentals
.47*	.41	.61*	.75*

* Significant at P < .05.

teachers commented upon the rapid pace of their activities.

On a given date in the middle of the 1961-62 school year, nine teachers kept a verbatim record of every question asked by the pupils in one of their experimental sections during one class period. Many teachers followed the simple expedient of requiring their pupils to write out each request or question on that day. The questions were later classified as "procedural" or "instructional." If, in the teacher's opinion, the proper answer to the question would directly and immediately contribute to the better understanding of, or greater skill in, the content of the course, the question was classified as "instructional." Most of the decisions regarding classification were routine, although some decisions were moot and based upon the inferred motivation of the student. A summary of the number of questions in each category asked each teacher is presented in Table 20. A few questions were asked in each class which were irrelevant to the purposes of the exercise and thus are excluded from the summary, e.g., "May I borrow a pencil?" or "May I be excused?" Samples of typical questions in each category are listed in Table 21. On the average, two procedural questions or requests were made to each instructional question or request.

TABLE 20

Number of Questions Asked by Pupils in One Class Period, Experimental Treatment

Teacher	Instruction	Procedural	Total
1	3	10	13
2	7	10	17
3	5	18	23
4	9	14	23
5	3	21	24
6	9	16	25
7	10	16	26
8	8	22	30
9	22	26	48.
Total	76	126	229
Median	8	16	24

TABLE 21

Typical Procedural Questions Asked by Pupils in the Experimental Sections

1. How many problems are you allowed to miss on Test B?
2. May I have the Unit B self test?
3. Do you do the first or last exercises if you failed Test A?
4. Did I pass Test A?
5. Where are the keys for the self test of Unit 4?
6. Is number 19 of the Diagnostic Test in Unit 5 wrong in the answer key?
7. Will you please correct my paper?
8. Should we reduce the remainder to lowest terms?
9. Do you want me to check this or do you want to?
10. What test do I take now?

Typical Requests for Instruction by Pupils in the Experimental Sections

1. I do not understand how to do problem number 4.
2. What does "equal" mean?
3. I can't figure out what is wrong with my answer to number 10.
4. How would you change 4/5 to hundredths?
5. How do you check multiplication?
6. I can't find out how many minutes in a week. What do I do?
7. How do you reduce fractions?
8. I can't find a common denominator for number 13.
9. What does "to express" mean in problem 16?
10. Does "product" mean multiply?

Teacher Comments on Experimental Program

In the spring of 1962, the participating teachers were asked for comments on the advantages and disadvantages of the experimental method. The comments were summarized after eliminating the more general and platitudinous observations. The major advantages and disadvantages cited by the teachers are given in Table 22.

TABLE 22

Disadvantages of the Experimental Method as Seen by Teachers

1. There is a loss of time in explaining to a large number of students individually what could be explained collectively to a group.

2. Slower students do not have the opportunity to encounter as much material.

3. There is not enough time to help students individually, especially the slower students.

4. Timid students may not ask questions that are important to their understanding.

5. Some students work too rapidly to develop understanding.

6. It is difficult to keep remainder of class working when talking with a single student.

7. Some students are not prepared to comprehend materials by reading on their own.

8. There is little chance to create interest by discussing mathematics with the class.

Advantages of the Experimental Method as Seen by Teachers

1. The teacher can pin-point a pupil's difficulties sooner.

2. Pupils feel freer to ask questions.

3. Absentees do not find themselves out of touch with their mathematics when they return.

4. Substitute teachers can easily take over classes.

5. Students are not tied to their desks.

6. Eliminates repetition for bright students.

7. It is easier to discuss student problems with parents.

Table 23 summarizes the major recommendations made by the teachers.

TABLE 23

Teacher Recommendations for Improvement of Experimental Method and Materials

1. Eliminate diagnostic tests or have tests only on certain days to allow closer supervision.

2. Supply supplementary units for slower students.

3. Provide more detailed procedural instruction in the units.

4. Limit the size of the classes to 20-24.

5. Sub-divide the units to permit sense of progress for slower students.

6. Explain the advantages and usefulness of the material in each unit in the unit introduction.

Teacher Perception of Pupil Differences

Did the individualized method change the behavior of students as perceived by the teachers? In an effort to answer this question, each of the nineteen teachers who had taught both control and experimental sections was asked to complete a survey form for each of their classes. The form made the following six requests:

1. List the four most capable math students in this class.

2. List the four least capable math students in this class.

3. List the four students with the best work habits.

4. List the four students with the poorest work habits.

5. List four who have occupied the most of your time for instructional purposes.

6. List four who have been the biggest discipline problems.

The names thus obtained from the control and experimental sections of each teacher were then used to prepare a second form in the following manner. The name of the most capable pupil in a control class was paired with the name listed as the most capable in an experimental class. The order in which the names appeared, i.e.

experimental-control or control-experimental was determined by chance. Then the next most capable students from each list were paired until the set was exhausted. The procedure was repeated for each of the six sets of names. Two pairs of the most capable and two pairs of the least capable mathematics students were grouped into a single set on the second form. The form, therefore, contained five sets of names. Each teacher was given this new form with the following instructions: "Listed below are the names of pairs of students you have taught this year. On each line underline the member of the pair who best fits the description." The five sets of four pairs of names each had one of the following headings: The student with: (1) the better work habits; (2) the poorer work habits; (3) the student with whom you spent the more time; (4) the student who was the more trouble in class; (5) the student who learned more this year. The results of the paired-comparison choices by the fifteen teachers included in this analysis are given in Table 24. Each choice in a given series was independent of every other choice, and the probability of any choice was .5. Therefore, the null hypothesis in regard to treatments was readily tested.

All comparisons show more experimental pupils selected than control pupils. However, only two of the five ratios could be considered statistically significant. Of all pupils in both treatments who required much of the teachers' time, the experimental pupils were the more demanding in 52 out of 60 cases. Interestingly, and in contrast to the standardized achievement test results presented earlier, the teacher perceived the experimental pupils to have learned more than the controls in 46 of 60 cases. However, if these 60 pairs be separated into the 30 pairs of pupils whom the teachers considered to have been the most capable, and the 30 pairs whom they considered to have been the least capable, new ratios are uncovered. Twenty-seven of 30 decisions among pairs of capable students were in favor of experimental students, whereas only 19 of 30 decisions among those who were least capable students were favorable to the experimental group. Only in the case of the capable students is the ratio significant.

Relationship of Achievement Gains to Teacher Personality

Permission was obtained in the school year 1962-63 to administer to participating teachers two experimental preference schedules developed by Stern and Masling (1958). The first of these schedules, Gratifications (Form G 958), is described as intending to investigate teachers' preferences for various aspects of teaching. The schedule consisted of a number of statements describing many kinds of activities, events, and situations relating to teaching. The teacher was asked to indicate one of six levels or degrees of preference for each statement. The second schedule, Attitudes (Form A 958), was

TABLE 24

Teacher Paired-Comparison Choices of Pupils on Five Characteristics.
Four Pairs in Each Cell

Teacher	Better Work Habits		Poorer Work Habits		Required More Time		Was More Trouble		Learned More	
	Exp.	Con.	Exp.	Con.	Exp.	Con.	Exp.	Con.	Exp.	Con.
M	3	1	1	3	4	0	2	2	3	1
P	3	1	4	0	4	0	4	0	2	2
O	1	3	1	3	4	0	2	2	3	1
H	3	1	1	3	3	1	2	2	3	1
B	3	1	4	0	4	0	3	1	4	0
D	2	2	4	0	3	1	2	0	2	2
K	1	3	1	3	4	0	4	0	4	0
C	0	4	2	2	4	0	3	1	2	2
Q	2	1	2	2	4	0	3	1	4	0
R	4	0	2	2	3	1	1	2	3	1
L	2	2	3	1	4	0	2	1	2	2
S	4	0	4	0	3	1	1	3	2	2
G	1	3	3	1	1	3	2	2	4	0
T	4	0	2	2	4	0	0	4	4	0
V	3	1	1	3	3	1	2	2	4	0
TOTALS	37	23	35	25	52	8	33	23	46	14
					$P < .05$				$P < .05$	

designed to investigate teachers' attitudes towards different kinds of teaching practices. This schedule consisted of a number of statements stating different opinions about methods and aims of teaching, desirable and undesirable pupil behavior, etc. The teacher was asked to indicate degree of agreement for each statement by marking one of six categories that ranged from "strong agreement" to "strong disagreement." Both of the schedules provided scores on ten trait categories. The scores for fifteen teachers and the mean arithmetic achievement gains of their pupils is given in Tables 25 and 26.

The correlations between each trait score and the pupil mean achievement gain is presented in Table 27. Of the forty correlations, three are significantly different from chance with $p < .05$. To reject the null hypotheses at the $p < .05$ in three out of forty independent t-ratios is courting Alpha, or Type I, errors. Nevertheless, since the purpose of these correlational analyses is hypothesis seeking rather than hypothesis testing, a look at each of the three correlations is indicated.

The correlation of -.57 between exhibitionism and mean class gains in reasoning was the only significant correlation involving either an attitude score or reasoning gains. The items on the attitude schedule that reflect exhibitionism are given as Table 28 in Appendix D.

Two Gratification scales correlate significantly with gains in Fundamentals--a correlation of +.50 with orderly characteristics and +.52 with dominant characteristics. The items which reflect these two traits in the schedule are given in Tables 29 and 30 of Appendix D.

TABLE 25

Teacher Preference Test Scores and Corresponding Mean Arithmetic Reasoning and Fundamentals Gain for 1962-63

Form G958 (Gratifications)

	Practical	Status-striving	Nurturant	Non-directive	Critical	Preadult Fixated	Orderly	Dependent	Exhibitionistic	Dominant	Mean Arithmetic gains 1962-63	
Teacher	1	2	3	4	5	6	7	8	9	10	Reasoning	Fundamentals
A	23	55	43	44	46	33	47	47	40	38	1.2	1.4
B	39	43	43	44	47	46	43	29	39	45	1.4	1.5
C	36	34	35	25	27	20	26	26	24	36	1.1	0.8
D	36	54	46	52	48	40	38	36	36	40	0.0	0.6
E	33	38	41	34	18	29	41	21	41	33	0.9	1.2
F	22	44	48	41	51	27	26	32	34	30	0.3	0.6
G	21	46	45	44	40	43	45	49	48	37	1.1	1.9
H	23	42	48	41	51	26	26	32	34	30	0.8	0.6
I	33	53	41	44	42	31	29	37	44	34	0.9	1.7
J	37	47	51	27	56	39	41	36	41	48	0.5	1.1
K	35	53	54	50	51	43	37	42	39	50	1.1	1.5
L	36	55	42	38	58	36	36	42	41	37	0.4	1.3
M	31	57	45	43	39	21	26	34	24	27	1.9	1.0
N	53	53	54	56	48	51	31	49	46	46	0.7	1.5
O	33	60	55	58	60	53	33	51	58	21	0.4	0.5
Total	491	734	689	634	682	538	525	563	589	552	127	172
Average	33	49	46	43	45	36	35	38	39	37	0.8	1.1

TABLE 26

Teacher Preference Test Scores and Corresponding Mean Arithmetic Reasoning and Fundamentals Gain for 1962-63

Form A958 (Attitudes)

	Practical	Status-Striving	Nurturant	Non-directive	Critical	Preadult Fixated	Orderly	Dependent	Exhibitionistic	Dominant	Mean Arithmetic gains 1962-63	
Teacher	1	2	3	4	5	6	7	8	9	10	Reasoning	Fundamentals
A	18	47	45	42	28	26	38	41	33	35	1.2	1.4
B	28	38	30	30	29	35	41	33	35	35	1.4	1.5
C	15	32	26	20	21	22	15	30	20	20	1.1	0.8
D	34	48	49	55	40	41	42	44	43	44	0.0	0.6
E	34	43	41	38	18	33	32	29	31	28	0.9	1.2
F	27	47	43	39	37	39	39	34	34	32	0.3	0.6
G	35	49	53	50	44	44	44	36	39	37	1.1	1.9
H	27	47	39	39	37	41	41	32	33	32	0.8	0.6
I	29	46	34	41	30	24	32	39	23	38	0.9	1.7
J	19	43	22	18	32	15	37	23	30	42	0.5	1.1
K	22	49	48	43	21	36	49	36	32	30	1.1	1.5
L	25	39	45	36	36	38	38	38	46	43	0.4	1.3
M	32	50	37	26	29	35	33	35	21	46	1.9	1.0
N	47	49	51	55	48	58	50	57	55	51	0.7	1.5
O	35	50	52	52	55	54	42	44	49	28	0.4	0.5
Total	427	773	615	584	505	541	573	551	539	541	127	172
Average	28	52	41	39	34	36	38	37	36	36	0.8	1.1

TABLE 27

Correlations Between Teacher Personality Traits and Mean Pupil Gain in Arithmetic Reasoning and Fundamentals

Teacher Traits	Arithmetic Reasoning		Arithmetic Fundamentals	
	Teacher Attitudes	Teacher Gratifi- cations	Teacher Attitudes	Teacher Gratifi- cations
1. Practical	-.07	-.11	+.09	+.14
2. Status-striving	-.12	-.10	-.08	+.07
3. Nurturant	-.27	-.27	+.07	-.14
4. Non-directive	-.40	-.14	+.08	+.04
5. Critical	-.48	-.43	-.20	-.03
6. Preadult fixated	-.25	-.27	-.12	+.26
7. Orderly	-.23	+.02	+.23	+.50*
8. Dependent	-.23	-.16	+.11	+.15
9. Exhibitionistic	-.57*	-.37	-.03	+.28
10. Dominant	-.08	+.01	+.27	+.52*

*Significantly different from zero at $p \leq .05$.

CHAPTER IV

DISCUSSION

It should be emphasized that references to "individualization of instruction" in this study refer specifically and exclusively to the methods and materials employed in the experimental treatment (see Chapter II). Therefore, generalizations of the results of this project to other school situations cannot be made on the basis of the term "individualization of instruction," but rather in terms of the specific characteristics of the materials and methods.

An hypothesis of the superiority of individualized instruction over conventional class instruction in seventh grade mathematics is clearly impaired by these results. Treatment effects were subjected to eight achievement gain comparisons in three analytical designs. In no instance was the gains of the pupils in the experimental treatment greater than the corresponding control group gains. Specifically, analysis of variance of gains revealed no significant differences between control and experimental mean gains in either reasoning or fundamentals for the pupils of twelve teachers in a groups-within-treatments design. For groups taught by eighteen teachers in a random replications design there were no significant differences between control and experimental treatments for either school-year or calendar-year gains in arithmetic fundamentals. Neither were there significant differences between calendar-year gains for this group in arithmetic reasoning. For the school-year, however, reasoning gains favored the control group by more than would ordinarily be expected by sampling errors alone. Further, there were significant differences in favor of the control group in both reasoning and fundamentals among four classes taught by one teacher in a treatment-by-levels design. In this later analysis ability level was found to interact significantly with treatment effects in the case of reasoning gains, e.g., treatments had a more marked effect upon differences between the slow classes than it did on the differences between the bright classes.

The hypothesis would have been discredited had the differences in treatment effect been found to be nothing other than null. Finding, in some cases, clearly significant achievement gains in favor of the control treatment is especially damaging to the premises of this study. Discussion of aspects of the materials and methods that appear to be related to the results should help indicate the direction of more fruitful future explorations.

The Teachers and the Method

Under the experimental treatment it is apparent that the teachers

did not have sufficient time to provide necessary instruction to individual pupils. Two major factors appear to have contributed to this problem. First, the instructional time of the teachers was pre-empted by procedural problems. Second, there is some question whether the materials carried as much of the instructional load as had been anticipated. Each of these factors bears commenting upon.

Powerful evidence of a major methodological weakness of the experimental treatment is provided by the tabulation of pupil questions in Table 20 and in the review of typical procedural questions listed in Table 21. The process whereby pupils progressed from one unit to the next demanded continual monitoring and supervision by the teachers. Virtually all of the procedural questions in Table 21 concern the prepackage tests that metered the pupils from one unit to the next. The procedural questions outnumbered the instructional questions by a factor of two-to-one. Keys to assist the teacher in scoring tests were provided with each unit; nevertheless, the problems associated with managing the materials were formidable.

Instructional inadequacy for some pupils of some parts of the materials is suspected, but it is more difficult to document. Several observations appear pertinent to this point. The fact that a large number of pupils became "bogged down" on the early units, and the distress that this occasioned among the teachers, has been mentioned. As of March 8, the date represented by the distribution in Figure 1, approximately 44 per cent of the total 1,065 pupils were working on, or below, unit five. The first five units are all concerned with the basic operations with whole numbers and fractions, (Table 2). Most teachers considered these topics to be "review" or "remedial" and below seventh grade level. There was also the frequent comment that the slower students did not have the opportunity to encounter as much material in the experimental sections as they did in the control sections (Table 22).

None of these observations is conclusive evidence of inadequacies in the materials. Indeed, the opportunity for weak students to move slowly and to repair long-standing deficiencies in their mathematical gackgrounds was a desirable characteristic of the program. More damaging, however, were the observations that some students could not comprehend the materials by reading alone. Recommendations for supplementary units and for sub-division of the units to give the slower students more of a sense of progress were also made by the teachers (Table 22). The sample of typical student requests for instructional assistance, (Table 21) suggests a variety of problems, (e.g. vocabulary hurdles and opaque explanations) which may have been associated with the materials.

Minor editorial and production problems contributed to the difficulties the teachers had with the materials. Typographical and other errors are not uncommon in early drafts of materials

such as these were. Occasional errors in keys used by teachers to score pupils' tests would eventually require much additional time on the part of the teacher to clarify the matter with the student. Subsequent hesitant and wary use of materials that were intended to be time savers would also result.

That the teachers generally felt positively toward the experimental treatment is supported by the paired-comparison study (Table 24). It does not appear likely that deficiencies in the experimental treatment can be attributed to a negative attitudinal bias on the part of the participating teachers.

Teacher Personality Studies

Against this background of time pressures on the teacher springing from problems with the materials and the need to deal with an accumulating backlog of demands for individual instruction, the results of the correlational study of teacher personality characteristics with pupil achievement gains is particularly interesting (Tables 25 and 26). Those teachers whose classes gained more in arithmetic fundamentals appeared to be more than ordinarily gratified by "orderly" and "dominant" behavior. It is intriguing that many of the items that reflected these characteristics on the personality schedules,(Tables 29 and 30) are antithetical to the concept of a completely individualized approach to instruction. Thus it appears that pupils under teachers who preferred a stringently structured classroom tended to make the most progress. One interpretation of these results is that the materials and method did not inherently exert sufficient control and direction over the classroom behavior of the pupils and it required the control of the teacher to counter the centrifugal forces of individual differences and to bring order out of chaos. The negative correlation of "exhibitionism" with reasoning gains does not appear to illuminate the results of the study.

Slow Pupils and the Experimental Treatment

The analysis of the data in the treatments-by-levels design, (Tables 14 and 16), teacher comments, (Tables 22 and 23) and teacher perception of pupils, (Table 24), all consistently point to the especial problems of slower students under the experimental treatment. The paired-comparison study of pupils indicated that the teachers felt that more of the best, as well as more of the poorest students, were learning more in the experimental sections as compared with the control sections. However, the ratio for slower students was not significantly in favor of the experimental group.

The Correlational Studies of Achievement Gains

The post hoc correlational studies reported in the results

section can be only suggestive, (Tables 18 and 19). Students and teachers were not randomly assigned to schools, and therefore correlations of variables within treatment groups must be interpreted cautiously.

The large and significant positive correlations between achievement gains and initial mean achievement levels for both control and experimental groups, (Table 19) indicates that pupils in both treatments who were better prepared at the beginning of the school year gained more from whatever program they were in than those who were not so well prepared. It would be useful to know whether the larger initial vs. gains correlation would continue to be associated with the experimental treatment were the study to be repeated. Such an eventuality would tend to extend the understanding of the significant interaction found between levels and treatments.

The correlations among initial scores, gains, and progress in the units (reported in Table 18) are also the source of speculation. The observation that progress in the units was not significantly related to achievement gains after initial score variance was partialled out is interesting. If progress in the units is considered to reflect a quantification of the independent variable (the experimental treatment) then achievement gains obviously represent the dependent variable. Thus, it might appear that the units made no contribution to achievement gains. One obvious weakness in this logic is that the usefulness of the experimental treatment is not necessarily related to how many units a pupil, or a class, completed in a given period of time.

Pupil Personality Factors

There is much to suggest that student personality factors greatly influenced the rate of progress through the materials. It will be remembered that the student was free to skip through the units to the tests at the end of the units. It was neither possible nor desirable to continually monitor the work of all pupils. Thus, the compulsive child would plod carefully through all the drill materials before attempting a unit test. Other children would characteristically attempt to finesse the procedure by skipping boldly to the test before reading the text materials, much less completing the exercise. The teachers commented upon other personality differences in noting that the timid or reticent child would not seek help when it was needed (Table 22).

That the design of the experimental method and materials explicitly considered the matter of individual differences in prior arithmetic achievement now serves to point up the fact that many other varieties of individualities existed in the children from which there were no particular provisions.

Associated with student personality characteristics is the matter of pupil motivation. Teachers felt that a loss of group instruction adversely affected pupil interest in mathematics. Low motivation was especially attributed to the slow students. There is reason to assume motivation and progress in the units were reciprocally related, and that the nature of the treatment may have yielded low motivation from little progress. It is not difficult to imagine that the cycle of drill and failure would soon lead to loss of enthusiasm in the case of the weak student who, having failed a unit test, was faced with repition of the same type of exercises and drill.

In the beginning of the program the teachers were given suggestions, (Chapter II, Appendix B) regarding procedures. They were, however, free to establish for themselves the cut-off grade on the unit tests which would be needed to pass a child from one unit to the next. The teachers became increasingly lenient with marks on the unit tests and increasingly demanding on the number of units a student should pass. This phenomina probably reflected both a desire to give students a sense of progress, as well as a compulsion to see that the students "covered the material."

More extensive interpretation of the results is inhibited by the holistic and amorphous character of the experimental treatment. The importance of identifying specific aspects of materials and methods which illuminate the results of the study has been mentioned. However, the complex interdependence of method and material in this study raises a number of questions, the answers to which must remain conjectural. For example, had the unit materials profited from professional editing and publication supervision would this have appreciably alleviated the burden on the teachers? Would the availability of teachers' aides to help with the testing problems, thus permitting teachers to devote full time to instruction, have solved the problems of the slow learners?

The overall impact of the study is clear. A quotation from Flournoy and Otto (1959) highlights the findings in an unusually cogent fashion. Speaking of completely individualized instruction, a la the "Winnetka Plan," they stated:

> Theoretically the plan has many points in its favor. Its practical limitations have curtailed widespread usage. Its primary prerequisite consists of carefully prepared self-teaching materials so organized that each child can move forward with a minimum of teacher time and with maximum self-directed individualization to care for differential pupil needs in the developmental as well as the practice phases of each topic. The task of preparing, merchandising, purchasing, and managing such materials has not been solved to the satisfaction of many practical-minded

school teachers and administrators. Another practical limitation is the diminishing level of pupil motivation when each child works entirely by himself. The motivation problem is particularly acute for slow learners or others who are encountering many difficulties. Completely individualized instruction makes little provision for the motivation that comes from being a member of a group engaged in the same task; class spirit tends to reach a point of no consequence. Research evidence is as yet too meager to tell us how much and in what directions individualized instruction affects motivation and ultimate achievement.

We can echo the statement that "The task of preparing . . . and managing such materials has not been solved . . . ." However, research evidence is now available which would indicate that individualized instruction can affect motivation and ultimate achievement in an adverse manner.

To determine the optimum mix of materials and teachers in the instructional program will require more analytical designs than the one employed in this study. The objectives of future studies need a much sharper statement. The effectiveness of the method will need to be evaluated in the context of the demands on the limited resources, both professional and financial, available to the school. These considerations appear to emphasize the value of the attention currently given to the "systems approach" in instructional planning, (Carter and Silberman, 1965).

CHAPTER V

CONCLUSIONS

Individualized instruction in mathematics, as administered in this study, did not prove to be superior to conventional class group instruction provided by the same teachers. Success was measured in terms of arithmetic achievement test gains. Directly contrary to expectations, the mean school year gains in arithmetic reasoning of the conventional classes of eighteen teachers were significantly better than the mean gains of the experimental sections. Further, a treatment-by-levels analysis of scores in four classes taught by the same teacher revealed that both the bright and the slow control classes gained more than their experimental counterparts. There was statistical evidence as well as teacher observations to indicate that slower pupils were especially handicapped by the experimental methods relative to conventional instruction.

A variety of factors that are suggested as contributing to these results include: the inordinate amount of the teachers' time that was required to deal with procedural problems in the experimental classes, and problems with the special materials. Most of these problems related to managing the pre-packages tests used to determine whether a pupil was ready to move to the next unit. There were also indications that the special materials that comprised the units suffered from weaknesses. Typographical errors, vocabulary levels, and inadequate explanations were all sources of concern to the staff, teachers, and pupils.

Personality characteristics of both teachers and pupils influenced the progress of the pupils with the experimental materials. Teachers with relatively high personality test scores in "orderliness" and "dominance" had the more successful classes as measured by gains in arithmetic fundamentals. Teachers with relatively low scores in "exhibitionism" had classes with better gains in arithmetic reasoning.

The pupils' relative freedom to move through the unit materials at their own pace revealed many idiosyncrasies in work habits. There were no provisions built into the method or the materials to deal with the dawdler or the dilettante, the compulsive or the careless child. The need for individualization of approach is as great in regard to these non-cognitive characteristics of children as in regard to differences in achievement and ability.

The holistic nature of the experimental treatment limited the heuristic value of the results. For future attacks upon the complex problem of individualization, it was suggested that a "systems analysis" approach would be more fruitful.

CHAPTER VI

SUMMARY

Twenty-eight seventh grade mathematics teachers of the Volusia County, Florida schools participated in a year-long project to evaluate individualized instruction as compared to conventional class group instruction. The materials and methods used in the experimental individualized instruction program consisted of specially prepared units of text, exercises and tests covering the traditional content of seventh grade mathematics. All told, the teachers taught thirty-eight classes of 991 pupils under the experimental treatment and twenty-seven classes of 735 pupils under the control treatment during the principal year of the experiment. Twenty-eight classes of 675 pupils served as controls the year prior to the major study.

Eighteen teachers, who had been assigned by their schools to more than one section of seventh grade mathematics, formed a major experimental subset within the project. Experimental and control treatments were randomly assigned to the sections taught by these teachers so as to comprise a random replications design. Twelve teachers who had taught in the same school conventional seventh grade classes the previous year formed another, and overlapping, subset. The classes of these teachers were cast into a group-within-treatments design. One teacher taught four classes scheduled from a sample of pupils who had been divided into high and low ability levels and then randomly assigned to experimental and control treatments.

The dependent variables were arithmetic achievement gains as computed from before and after testing with parallel forms of the mathematics test from the California Achievement Batters (Junior High School). Separate analyses were calculated from reasoning and fundamentals sub-test scores. A variety of other observations collected during the year provided data helpful in the interpretation of the results. The results of analyzing the achievement test gains not only failed to substantiate the superiority of the experimental treatment but revealed, in some cases, significantly higher gains for the pupils taught under conventional instructional methods

The poor showing of the experimental approach was attributed to the heavy demands that manipulation of the experimental materials placed upon the teachers. In a typical hour, pupils raised twice as many questions about procedural matters, chiefly the unit tests, as they did questions about mathematics. Further, the

materials were felt to need editorial improvement and revision to provide more adequately for the needs of slower pupils.

Individualization of materials and methods should consider not only differences in ability and achievement among pupils, but also the attitudinal, motivational, and other non-cognitive aspects of both pupils and teachers. This was not done in this experiment. A "systems approach" is felt to present more fruitful directions for future research.

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APPENDIX A

	Names of Participating Teachers 1961-62	Prior Years Teaching Experience
1.	Adams, N.	1
2.	Ballard, G.	5
3.	Bottom, L.	6
4.	Broadwater, D.	8
5.	Cockerhan, J.	3
6.	Daniels, A.	2
7.	Earnest, L.	13
8.	Eubank, G.	20
9.	Fagan, O.	6
10.	Fisher, C.	0
11.	Hutchings, R.	20
12.	Jennings, R.	7
13.	Kennedy, D.	5
14.	Kennedy, L.	20
15.	Langford, R.	3
16.	Long, Wm.	20
17.	McCrary, E.	5
18.	Mims, E.	1
19.	Molander, M.	14
20.	Phillips, F.	33
21.	Phillips, K.	1
22.	Robertson, A.	13
23.	Robinson, H.	29
24.	Romano, A.	12
25.	Shafer, C.	8
26.	Spangler, L. G.	12
27.	Thompson, D.	4
28.	Wooten, H.	3

APPENDIX B

Suggested Classroom Procedures

The following procedures have been developed over a four year period. It is hoped that each teacher participating in the program will critically appraise these procedures on a continuing basis so that they may be developed to the highest degree possible. In fact, this attitude should be applied to every phase of the program because by its very nature, the program has almost limitless possibilities for improvement. Actually, it is limited only by the imaginations of those involved in the project.

PROCEDURES:

I. REVIEW

A. The first week or so should be spent reviewing fundamental arithmetical operations since much may have been forgotten during the summer.

II. DIAGNOSIS

A After a thorough review, the diagnostic test should be given.

1. The duration of the test depends upon teacher judgement. Since the purpose of the test is to discover weaknesses, ample time should be allowed to permit the best student to proceed as far as possible.

2. After a careful analysis of the test, each student should be assigned to a specific part of the text material (one of the units) depending upon his test results. For example, one student may need to start with the unit on dividing whole numbers, another on adding fractions, and so on.

III. WORKING ON TEXT MATERIAL

A. The units should be distributed one at a time.

1. Each student should completely finish a unit (they should not write on units so that they may later be used for review) and successfully pass a test on the unit before he is permitted to proceed to the next unit.

2. An attempt has been made to write the text material in simple language with a sufficient number of sample problems to enable students to proceed primarily on their own. However, should they need help, they should feel free to go to the teacher's desk for counselling. Since a prime goal of this program is to teach youngsters to think independently, it is suggested that a minimum of help be given. Be sure each youngster has thoroughly read and reread the material before rendering assistance.

3. As a student finishes an exercise, he should check his answers against an answer sheet that is readily available to him. He should not proceed to the next exercise until he has corrected any errors he may have made. (Again, he should be encouraged to find his own errors.)

4. After completing the unit and successfully passing the self-test (students should not write on any of the tests), he should have his work checked. The student should then place the material in his own folder and keep it, or file it in a drawer designated for this purpose.

5. The student is now ready to take Test A.

IV. TESTING

A. There are two tests on each unit: Test A and Test B.

1. Students should be required to take a minimum of four tests on four different units during each six week period.

2. If a student successfully completes 85 per cent of the material on Test A, he may proceed to the next unit.

3. Scoring less than 85 per cent will necessitate that the student thoroughly review the unit, do the self-test again, then request Test B. Since the student is being tested twice on the same material, his score on Test B should be cut 10 points. However, if his original score on Test B is at least 85, he should be permitted to proceed to the next unit even though the score is recorded as a 75.

4. If the student fails Test B, he should be asked to do the entire unit over again. He may then follow

the same procedure as before, but he cannot receive a passing grade for the unit regardless of his score on further tests. (For this reason A or B may be given on an alternate basis until the student masters 85 per cent of the material.)

B. Six weeks, semester, and final tests will all be "cumulative." Should weaknesses appear, the student should be asked to return to the appropriate unit for review.

C. A special file drawer for students' tests should be used. Each folder should contain a Cumulative Test Sheet so that each student will have an up-to-date record of his test results. A copy may also be kept in the student's folders containing the student's daily work.

V. GRADING

A. Each teacher is of course free to develop his own grading techniques. The procedures outlined below are merely suggestions.

1. One of the first things students should be made to understand about grading in an individualized program is that it would be grossly unfair to give a "D" to a student doing advanced work and an "A" to a student doing work on the 4th or 5th grade level.

2. Each teacher will have to determine what grade to give those working below the seventh grade level. Youngsters quite far behind should be told that they will not receive a failing grade provided they do the best they can. It should be also emphasized that by working beyond the call of duty, it is possible for them to move ahead to more advanced grades.

APPENDIX C

TO THE STUDENT

Do you like arithmetic? Are you good at it? As in most things requiring skill, these two ideas generally go together. A person who does something well, usually likes it. Those of you who do well in arithmetic and like it are fortunate. You should do quite well in this course. Those of you who have found it somewhat difficult, and may therefore not like it, can also do quite well in this course. All you need do is make an honest effort and take advantage of the fact that in this course your teacher will be readily available to give you personal help during class time whenever you need it.

Therefore, please read the following very carefully. Then, after you have finished, study what has been said to be sure you understand i well enough to be able to explain it to someone else.

A DIFFERENT APPROACH

You are being asked to join in a program in arithmetic which will be somewhat different from the way you have been taught in the past. One big difference is that you will be working mostly on your own. However, this does not mean you are "to go it alone". Your teacher will be available to help you get over the rough spots whenever you feel you need the help. This help will be given to you personally at the teacher's desk.

Another difference in the program is that you may set your own pace. However, you are expected NOT to do rush work simply to get through quickly or to get ahead of everybody else, nor are you expected to move along at a turtle's pace. You will be required to do a minimum amount of work in order to pass. However, those who wish, may proceed as far as they like provided what they do is done thoroughly and well.

The basic plan is to give you one unit of work at a time. For example, everyone will start with Unit 1 on WHOLE NUMBERS, which includes reading and writing numbers, addition, and subtraction. Examine this unit now.

CHECKING YOUR SKILL IN ARITHMETIC

As you read through the material, you will soon come to a DIAGNOSTIC TEST which everyone must take. This first test is on reading and writing numbers. No grade will be given for this test; it is simply given to find out if you need help in this area. "Passing" the test (missing 4 or less) means you may skip over to Part II (ADDITION) of the unit. If a student misses more than 4,

he will need to start work on the material immediately following the diagnostic test.

It should be said at this time, that in a program such as this, the old saying that "honesty pays" will have a great bearing on a student's progress. It is extremely foolish to move ahead in arithmetic without thoroughly understanding what you are doing presently. It is useless for a student to try to multiply and divide if he is not expert in adding and subtracting. One of the main aims of this program is to have each student become expert in each of the units he is working on before permitting him to move onto new material. Whether or not a student may start new material depends upon how well he does on the tests which are taken as each unit is completed.

The part dealing with addition also contains a diagnostic test. The same plan is followed as before. Take the test, skip to subtraction if you are qualified to do so, or proceed through the material if you find that you need the review.

WORKING INDEPENDENTLY

There will be little lecturing and blackboard work done by your teacher. You are expected to move through the material on your own as well as you can. When you feel that you need help, you may seek it from the teacher at his desk. However, before you do, be sure you read the material several times, especially where sample problems are given. Use a dictionary to find the meanings of words you don't understand. By sincerely trying to solve your own problems before seeking help, you will be training yourself to think independently, and you will be building confidence in your own ability to handle arithmetic. As you solve problems on your own, you will find it easier and easier to do so as you move ahead in arithmetic. Thinking takes practice like any other kind of work. Developing these traits now will help you a great deal as you advance in school.

PRACTICE WORK

Every unit has a set of "exercises." These are to be done on your own paper neatly. Head your paper with your name, the date, the page and exercise numbers. After you do the first three items (a, b, c), check them yourself against the answer sheets. If you made any errors, correct them yourself if you can. If you cannot, review the text material, especially the sample problems. If you still do not quite understand the material, seek help from your teacher. However, if you did the first 3 items correctly, finish the set and check your work. Follow the same steps outlined above if you made mistakes or feel you need help from your teacher.

PLEASE DO NOT WRITE ON ANY OF THE MATERIALS GIVEN YOU. USE YOUR OWN PAPER IN ALL OF YOUR WORK.

When all of the exercises in a unit have been completed, take them to your teacher so they may be checked in. You should keep these plus all diagnostic tests in your own folder for future reference. You may need to review the material later in the school year.

TESTING YOUR SKILL

After completing your exercises and reviewing your work on a unit, ask your teacher for the SELF TEST. No grade will be given on the test, but you must pass it with an 85 to be able to take TEST A for which a grade will be given. All students, including those who "passed" all the diagnostic tests within the unit, are expected to take the SELF TEST and TEST A at the end of Unit 1.

ALL TESTS WILL COVER COMPLETE UNITS. CHECK THE TEST SCHEDULE TO BE SURE YOU ASK FOR THE CORRECT TEST.

Passing TEST A with an 85 or better means that you may proceed to the next unit. Place the finished unit in a permanent folder. Failing TEST A means that the student must review the contents of the unit, do the last three items of all the exercises, and finally request TEST B. The highest grade possible on this test is 90. Failing TEST B will require another review of the material, doing the last 5 items of all the exercises, and requesting TEST C for which no grade will be given. Taking TEST C will result in a failing grade for the unit, but an 85 must still be made to enable the student to move onto a new unit.

To pass at the end of a six weeks period, it is necessary that at least 3 units be completed including the taking of tests. After the course has gotten underway, your teacher will give you more details about how your grades will be determined.

APPENDIX D

TABLE 28

Items that Reflect Exhibitionistic Characteristics on the Attitude Test A958

Item No.	Items
1	One of the most important assets a teacher can have is the ability to make her class laugh.
5	A lesson is most sure of success if it is presented in a vivid and dramatic fashion.
11	A teacher has to be a super-salesman to get the students to learn anything.
25	One of the most important qualities for a teacher to have is a lot of "personality."
27	A good teacher never presents the same material in the same way twice.
48	A little clowning is a good way to hold the students' attention and make the learning process more pleasant.
59	Pupils pay more attention to a teacher who is a little dramatic, a little out of the ordinary.
70	A colorful and amusing teacher is certain to be a good one.
84	Television has children so used to being entertained that the teacher has to be entertaining too in order to hold their attention.
93	A good teacher has to be part magician, part showman, and part salesman.

TABLE 29

Items that Reflect Orderly Characteristics on the Gratification Test G958

Item No.	Items
8	Having the pupils do over papers that are not neat.
10	Keeping careful and accurate records of pupil's progress, assignments, attendance, etc.
24	Following daily classroom routine faithfully.
32	Giving the pupils the opportunity for a lot of drill and formal recitation.
34	Keeping my classroom clean and neat
47	Scheduling activities of the school day, minute by minute.
49	Having the entire class do the same thing at the same time.
61	Making sure my pupils cover every bit of the curriculum.
65	Discouraging class discussions and other distractions from the planned lesson.
88	Following specific and carefully organized lesson plans.

TABLE 30

Items that Reflect Dominant Characteristics on the Gratification Test G958

Item No.	Items
14	Permitting no infractions of discipline, however minor, to go unnoticed.
36	Keeping my classroom so quiet that you can hear a pin drop.
40	Praising a child only when he's really done something deserving.
51	Permitting children to talk only when called upon.
55	Having a reputation among the pupils for being a strict teacher.
68	Running my class with a firm hand.
76	Holding the whole class responsible for any breaches of discipline.
80	Having my pupils know who is boss.
91	Making it clear to the youngsters that I won't tolerate any foolishness.
94	Having the pupils maintain proper respect at all times for my position as their teacher.